

WX-250

Digital Weather Receiver




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Chapter 1 - Introduction and Specifications

WX-250 Weather Receiver

The WX-250 is a highly sensitive quality receiver. A digital decoder responds to Specific Area Message Encoded (SAME) alerts transmitted by the NOAA weather station located in your geographic area. Select your county code and the type of alerts. Select warnings and or watches. During a weather alert, a relay in the WX-250 will disconnect the transmitter from your repeater's controller and connect it to the weather receiver. The relay provides a ground for the transmitter PTT line. Weather audio will be transmitted for the period of the alert announcement. A programmable alert time out timer provides back-up protection. An alert lasts typically 90 seconds.

Weather Alert Log

As alerts are received the WX-250 stores the date, time and type of alert in non-volatile memory. Storage space is provided for forty alerts. Use the RS-232 port and the WX-250 configuration program to download the data.

WX Alert Start Logic Output

An ALERT START output provides a TTL logic high one second pulse when a weather alert is received. This output can be used to set off an external alarm or trigger a controller to execute a "SEVERE WEATHER ALERT" macro.

WX Alert Stop Logic Output

Included in the digital packet is the length of the severe weather alert. The WX-250 stores this information and generates a stop logic output when the time period has expired. The STOP output provides a TTL logic high for one second. This output can be used to trigger the repeater's controller to change the repeater to "NORMAL" operation.

WX Alert Warning Logic Output

When a weather warning is received, this output goes low. It remains low for the duration of the warning period.

WX Alert Watch Logic Output

When a weather watch is received, this output goes low. It remains low for the duration of the watch period.

WX Alert Advisory Logic Output

When a weather advisory is received, this output goes low. It remains low for the duration of the alert period.

Weather Enable Input

When this input is grounded the weather receiver will activate. When connected to a controller's user function output switch, weather reports are available on demand.

Weather Disable Input

When this input is grounded the WX-250 will not respond to weather alerts issued by the NOAA weather station. Once a "Sky Warn Net" is activated, it may be desirable to stop any additional alerts. When this input is momentary grounded, the WX-250 will reset, canceling the active alert.

Periodic Voice Announcements

When the alert message is finished the weather station sends three termination data packets. Upon receipt of these packets the WX-250 will turn off the line audio and repeater transmitter. The voice synthesizer will continue to announce the alert until the time period has expired. The default setting is once every five minutes. You can change this time in increments of five minutes up to thirty minutes.

Transmitter Identification

The WX-250's voice synthesizer will identify your transmitter at the end of an alert and during the periodic voice weather announcements. Enter your station's identification and select additional words THIS IS, TRANSMITTER and REPEATER to the identification announcement

Alert Message Timer Selection

At the conclusion of an alert message the weather station send a digital termination packet. The WX-250 decodes this packet and turns the transmitter off. If the weather station fails to send the termination packet the alert message timer will take over. Select this time with the WX-250 configuration program. Most alerts last 90 seconds so this timer should be set for at least 120 seconds.

Specifications

Available NOAA Channels:	162.400 MHz, 162.425 MHz, 162.450 MHz, 162.475 MHz, 162.500MHz, 162.525 MHz, 162.550 MHz
Sensitivity Receive:	0.5 microvolts for 20 dB quieting
Sensitivity Decoder:	1.0 microvolts for 95% decoder accuracy
Modulation:	Narrow Band FM, 5KHz Deviation
Antenna:	50 Ohm, Type BNC Connector
Relay Closure:	2 Form C (DPDT) by Digital Alert Packet
Power:	+12VDC @ 100 ma, DC Power Type 2.5mm
Dimensions:	1.75" H x 19" W x 5" D
Operating Temperature:	-15 to +55 C

FCC Part 15 RF Interference

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. User changes or modifications to the WX-250 not expressly approved by Computer Automation Technology could void the user's authority to operate the equipment.

FCC Part 97.113.e Prohibited transmissions.

No station shall retransmit programs or signals emanating from any type of radio station other than an amateur station, except propagation and weather forecast information intended for use by the general public and originated from United States Government stations.

Chapter 2 – System Configuration

CAT-800 Controller Interface

Connect the WX-250 to the CAT-800 and the repeater as shown in Figure 1. PTT and transmit audio from the CAT-800 are connected to the repeater's transmitter through the normally closed contacts of the double pole double throw relay located in the WX-250. When power is applied, the WX-250 will announce the firmware version. When a weather alert is received, the relay will switch the weather alert audio to the TX audio input and provide a PTT signal to key the transmitter.

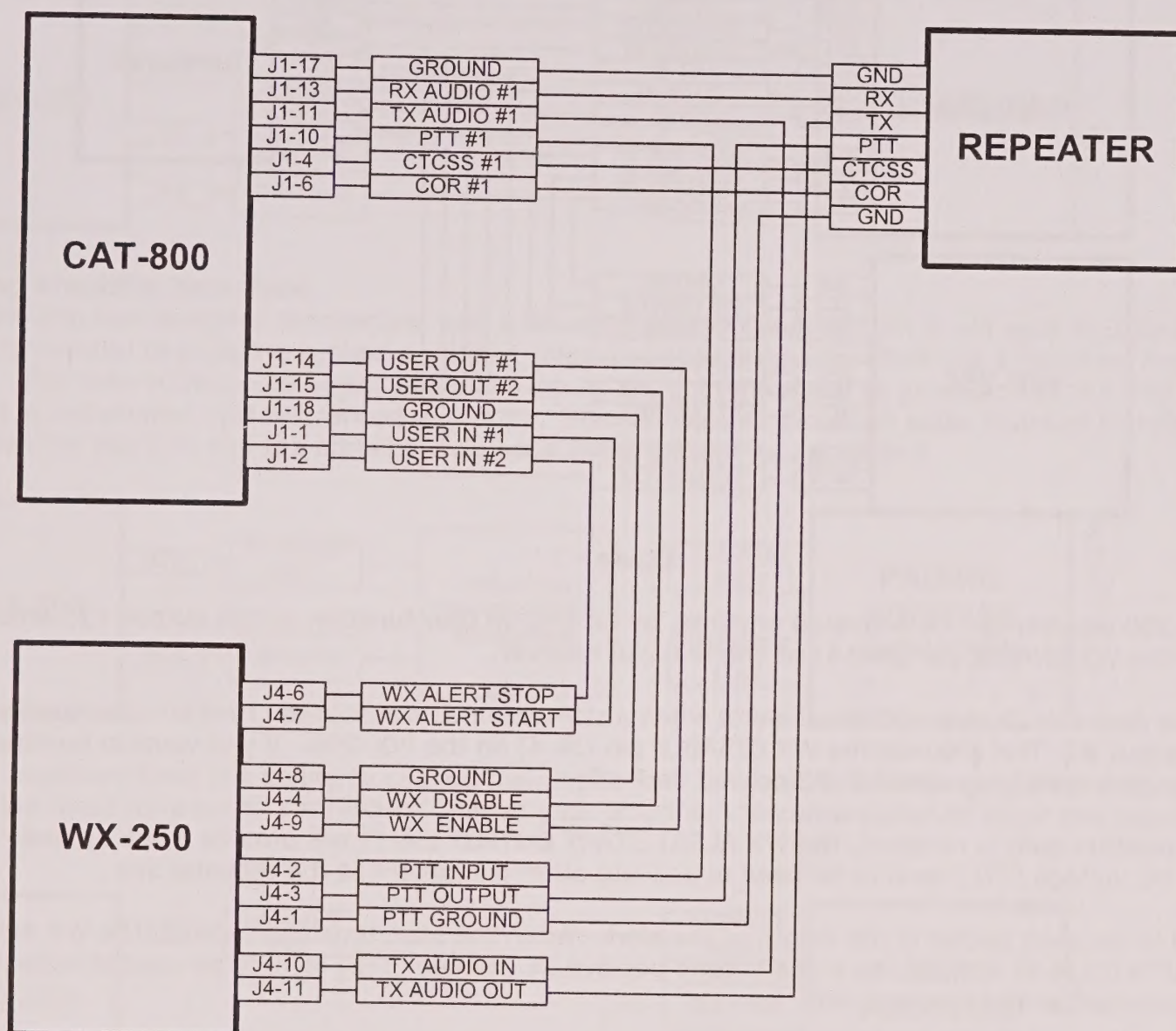


Figure - 1

NOTE: Turn off Zone 5 Channels 1 and 2 on the CAT-800 until logic inputs 1 and 2 are programmed to respond to the WX START and WX STOP pulsed outputs from the WX-250.

CAT-260 Controller Interface

Connect the WX-250 to the controller and repeater as shown in Figure 2. PTT and transmit audio from the controller are connected to the repeater's transmitter through the normally closed contacts of the double pole double throw relay located in the WX-250. When power is applied, the WX-250 will announce the firmware version. When a weather alert is received, the relay will switch the weather alert audio to the TX audio input and provide a PTT signal to key the transmitter.

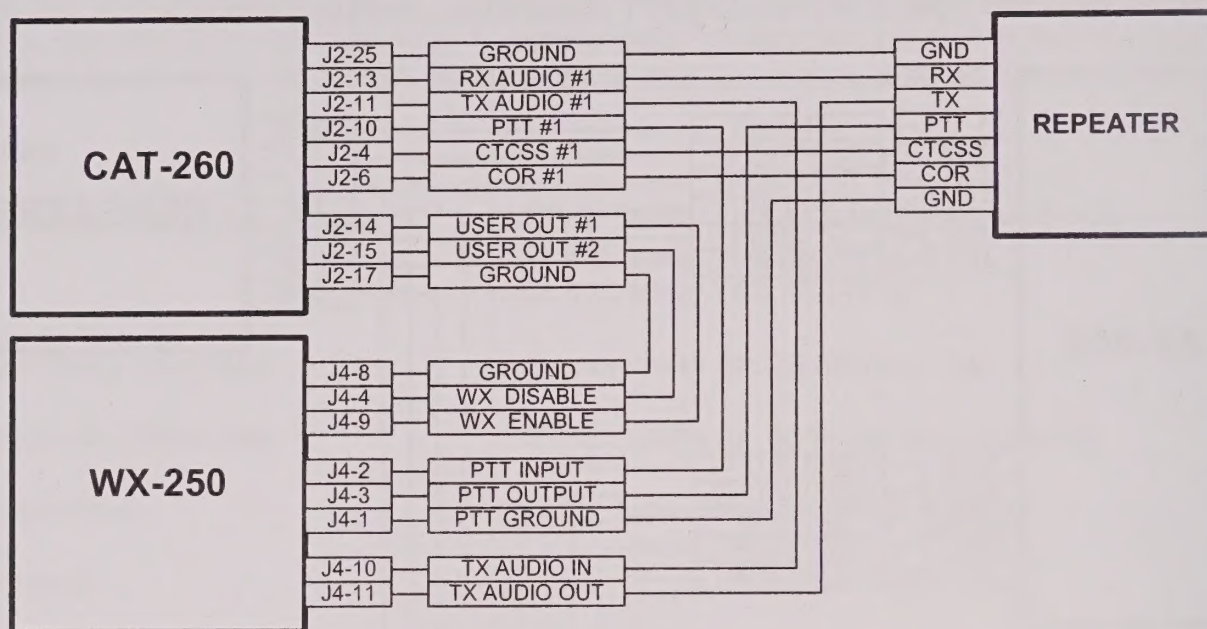


Figure - 2

The WX-250 receiver can be activated anytime, by turning on user function switch output #1, which grounds the WX ENABLE pin (J4-14) on the WX-250 receiver.

It may be desirable to stop additional alerts when a sky-warn net is activated. Turn on user function switch output #2. This grounds the WX DISABLE pin (J4-4) on the WX-250. If you want to terminate an active alert cycle output switch #2 on and back off.

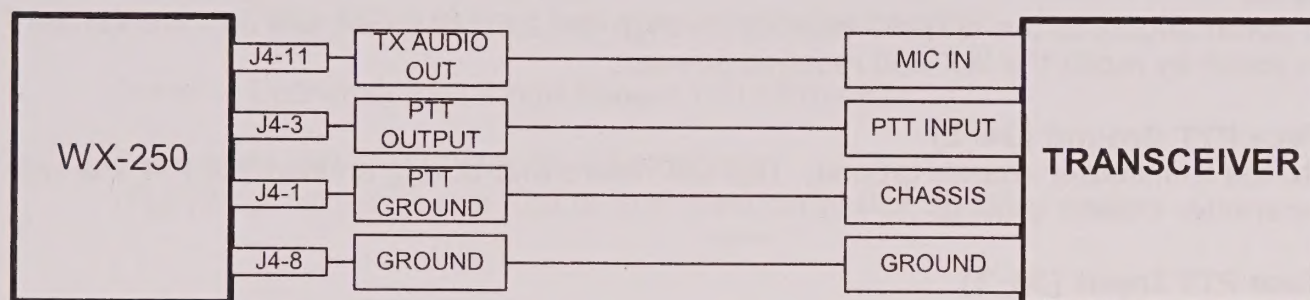
When a weather alert is received, the WX ALERT START OUTPUT (J4-7) will provide a one second positive DC voltage [TTL] level to be used to activate other equipment at the repeater site.

Included in the alert packet is the length of the alert. When the alert time has expired, the WX ALERT STOP OUTPUT (J4-6) will provide a one second positive DC voltage [TTL] level to be used to activate other equipment at the repeater site.

NOTE: Turn off Zone 4 Channels 1 and 2 on the CAT-260 or Zone 3 Channels 1 and 2 on the CAT-200C until logic inputs 1 and 2 are programmed to respond too the WX START and WX STOP pulsed outputs from the WX-250.

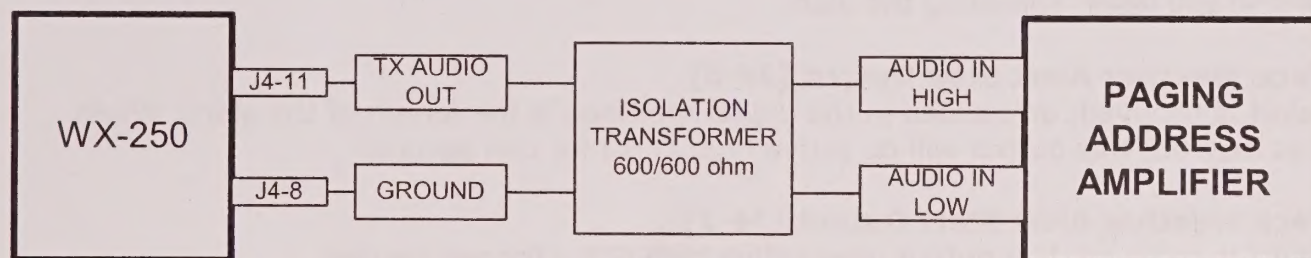
Remote Transceiver Interface

The drawing below describes how to connect a WX-250 to a transceiver tuned to a repeater's input. When an alert is received the WX-250 will key the transceiver. The microphone audio will be the weather announcement. The WX-250's voice synthesizer will identify the transmitter at the collusion of the weather alert. A transceiver's microphone audio input is very sensitivity. If you find the WX-250's audio output controls near their full counter clockwise position install a 100 ohm resistor between the MIC IN and GROUND.

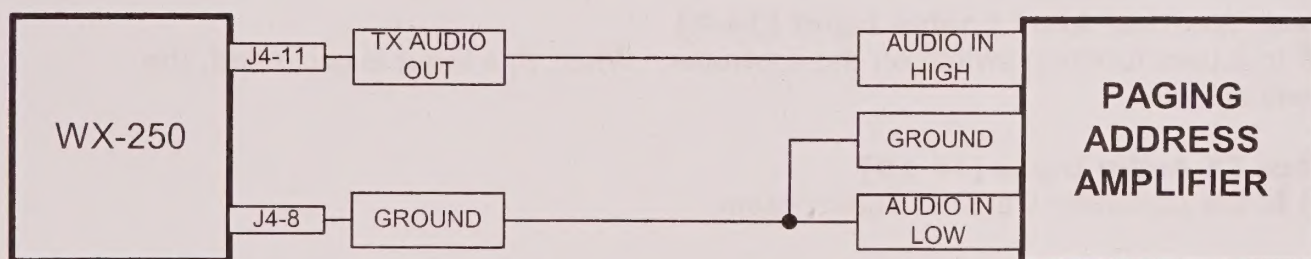


Paging Amplifier Interface

The WX-250 was designed to interface with a RF communication system but it will work equally well when connected to a paging system amplifier. Most public address amplifiers use a balanced audio input. This means the audio hi and audio low inputs are not referenced to ground. The WX-250 audio output is unbalanced, not referenced to ground. You will need to install an audio isolation transformer between the WX-250 and the amplifier. Select a Traid TY-304P or equivalent.



Some amplifiers have the ability to change their input from balanced to unbalanced by connecting the audio low input to ground. CAUTION: Consult your amplifier's documentation to see if this feature is available.



Headphone Interface J1

Plug a set of stereo headphones into J1 to monitor the NOAA weather station.

Computer Interface J2

Connect your computer's serial port to the WX-250 receiver at connector J2. Use a direct RS-232. This cable is a DB-9 male to DB-9 female with pins 2-2, 3-3 and 5-5.

12VDC Interface J3

Connect a 12VDC power supply to the WX-250 receiver through the 2.5mm power jack J3. The center pin is positive. In stand-by mode the WX-250 requires 60 ma.

Repeater Interface PTT Ground [J4-1]

Connect this pin to the transmitter chassis ground. This will insure that during an alert the PTT line will be returned to transmitter chassis ground.

Repeater Interface PTT Input [J4-2]

Connect this pin to the controller PTT output.

Repeater Interface PTT Output [J4-3]

Connect this pin to the transmitter PTT input.

Repeater Weather Alert Disable Input [J4-4]

Connect this pin to a user function switch on the controller. When this input is grounded, the receiver will not respond to alerts issued by the weather station. NOTE: When this input is momentary grounded, the WX-250 will reset, canceling the alert.

Repeater Interface Weather Alert Stop Output [J4-6]

When a weather alert is received, embedded in the digital message is the length of the alert. When this time period has expired, this output will go active high (TTL) for one second.

Repeater Interface Weather Alert Start Output [J4-7]

When a weather alert is received, this output goes active high (TTL) for one second.

Repeater Interface Ground [J4-8]

Connect this pin to controller ground. This provides a common ground between the controller and WX-250 receiver.

Repeater Interface Weather Alert Enable Input [J4-9]

Connect this input to a user function switch on the controller. When this input is grounded, the weather receiver will activate.

Repeater Interface TX Audio Input [J4-10]

Connect this input to the controller transmit audio output.

Repeater Interface TX Audio Output [J4-11]

Connect this output to the repeater transmit audio input.

Antenna Interface J5

The WX-250 has a very sensitivity receiver typically 0.5 microvolts. Extend the collapsible antenna and connect it to the BNC connector J5. If the WX-250 is located in a fringe area of the NOAA transmitter or in a windowless concrete and steel building an external antenna is recommended. Any VHF antenna covering 160 MHz will work.

For your consideration contact:

DX Engineering (800 777-0703) or (www.dxengineering.com)

1. Antenna Cushcraft AR2 Ringo Ranger P/N CSH-AR2
2. Coax cable (50 Feet) P/N DXE-8XDXBC050
(PL259 connector on one end to BNC Male connector on other end)

Chapter 3 - WX-250 Controls

Test Switch [S1]

Press [S1] to initiate a test sequence of the logic functions of the WX-250. NOTE: This test does not verify the operation of the RF1 receiver module.

Read FIP Code Switch [S2]

Press [S2] to initiate a read back of the FIP codes programmed into the WX-250. Perform this test after the WX-250 has been programmed to verify the correct county codes have been entered into the WX-250 memory.

Monitor Switch [S3]

Press [S3] to activate the headphone audio. Press the switch a second time to deactivate headphone audio. NOTE: This switch will also activate the transmitter.

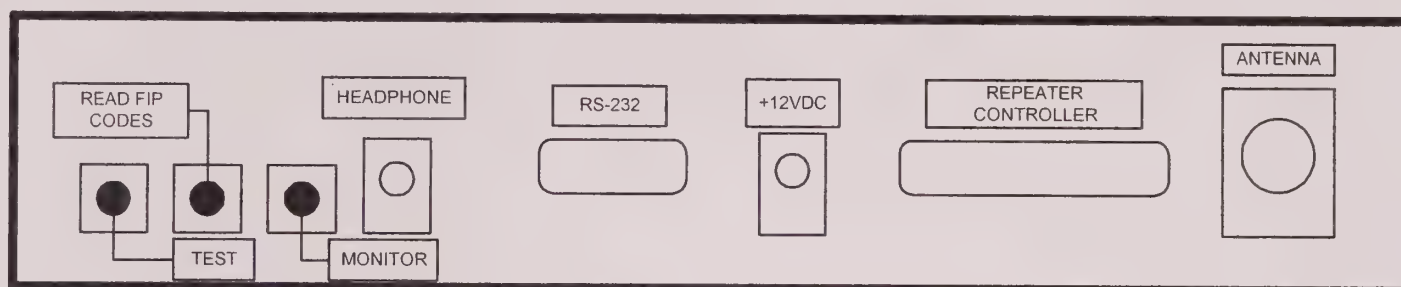


Figure - 3

Select Receive Frequency [S4]

The WX-250 is shipped with its frequency set to 162.400 MHz. To change to a different NOAA frequency, change the settings of the dipswitch per Figure 4.

S4-1	S4-2	S4-3	FREQUENCY
OFF	OFF	OFF	162.400 MHz
ON	OFF	OFF	162.425 MHz
OFF	ON	OFF	162.450 MHz
ON	ON	OFF	162.475 MHz
OFF	OFF	ON	162.500 MHz
ON	OFF	ON	162.525 MHz
OFF	ON	ON	162.550 MHz

Figure - 4

Audio Level Adjustments

Transmit audio from the controller has a direct connection to the transmitter through the WX-250. There is no need to readjust transmitter deviation. Press the MONITOR switch [S3] on the rear panel. Monitor the transmitter output. Adjust the LINE LEVEL audio control R13 for the desired level of NOAA weather station audio.

Press the FIP CODE switch [S2]. The voice synthesizer will announce the selected FIP codes. Continue to press [S2] as required until the VOICE LEVEL audio control R8 is adjusted for the desired voice synthesizer level. The Headphone audio output is fixed.

Dipswitch Settings

An eight position dipswitch is used to select the receive frequency, enable RS232 reporting and initialize the WX250.

Dipswitch #1

This switch in conjunction switch #2 and #3 selects the receive frequency.

Dipswitch #2

This switch in conjunction switch #1 and #3 selects the receive frequency.

Dipswitch #3

This switch in conjunction switch #1 and #2 selects the receive frequency.

Dipswitch #4

This switch is reserved

Dipswitch #5

This switch is reserved

Dipswitch #6

This switch is reserved

Dipswitch #7

This switch is used to enable reporting on the RS232 port.

Dipswitch #9

This switch is used to initialize the WX-250 and set all parameters to factory default when power is cycled with this switch on.

DIPSWITCH	FUNCTION
1	Receive Frequency Select
2	Receive Frequency Select
3	Receive Frequency Select
4	Reserved
5	Reserved
6	Reserved
7	Enable RS232 Reporting
8	Initialize WX-250 Receiver

Chapter 4 – Weather Receiver Editor Program

Configuration Programming

The WX-250 editor program requires a Windows XP through Windows 10 operating system. Install the program. From your desktop click the WX-250 Editor Icon to display the WX-250 SAME Weather Receiver Configuration Editor window.

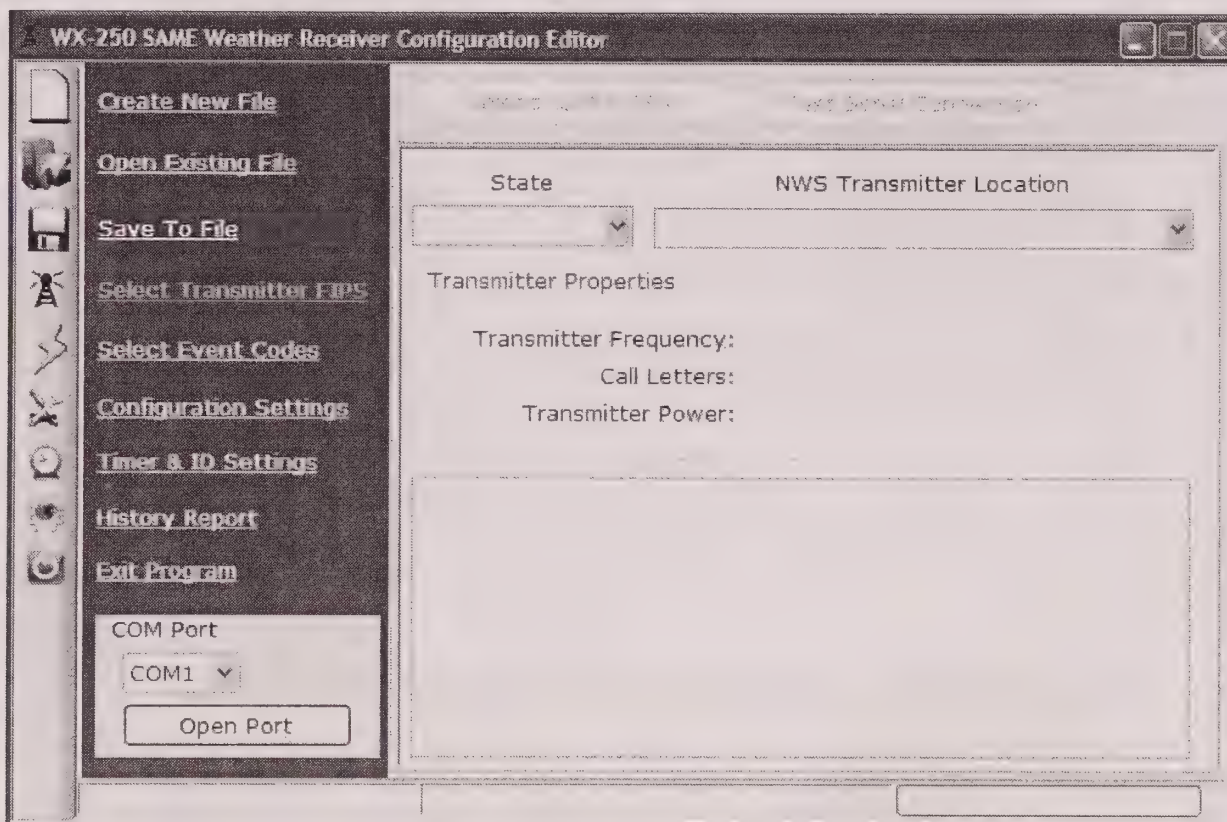


Figure - 5

Federal Information Processing Codes

Select the STATE and NWS Transmitter Location. The window will display the counties served by that transmitter. Check the boxes of the counties of interest

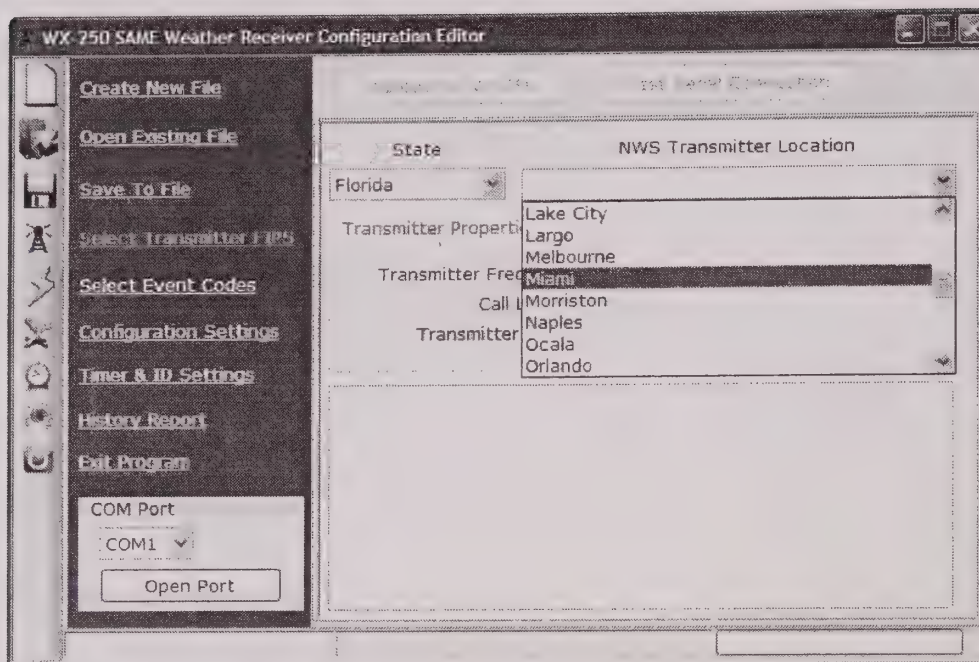


Figure - 6

WX-250 Event Codes

Select [**Select Event Codes**] to display a list of Weather Related Events. Check the boxes to select the Events of interest.

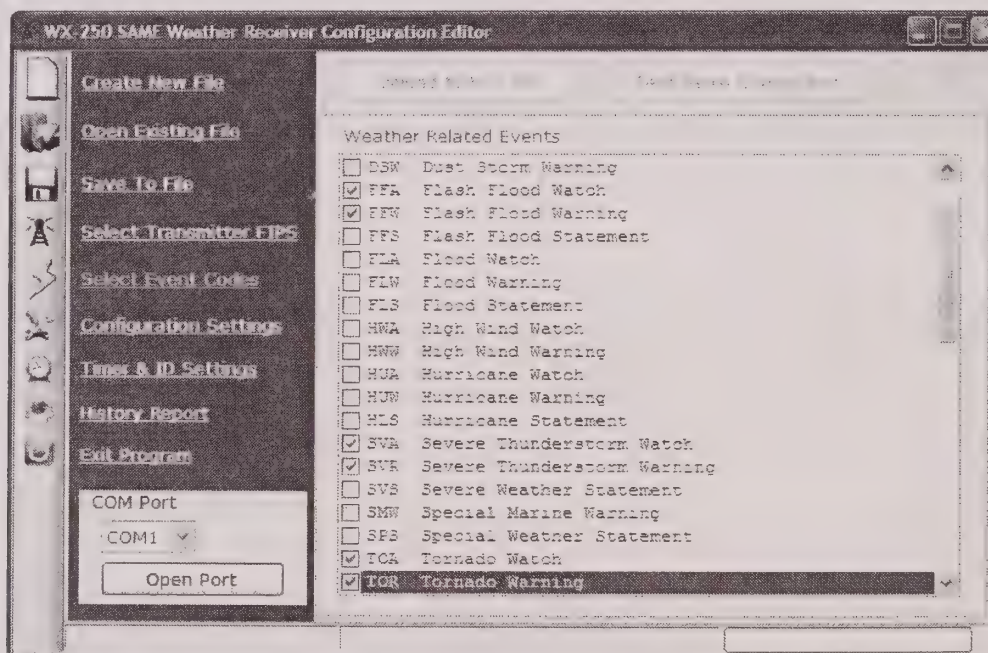


Figure - 7

WX-250 Configuration Settings

Select [**Configuration Settings**] to display a list of Receiver Override Options and Voice Interval Options. Check the boxes to select the desired options.

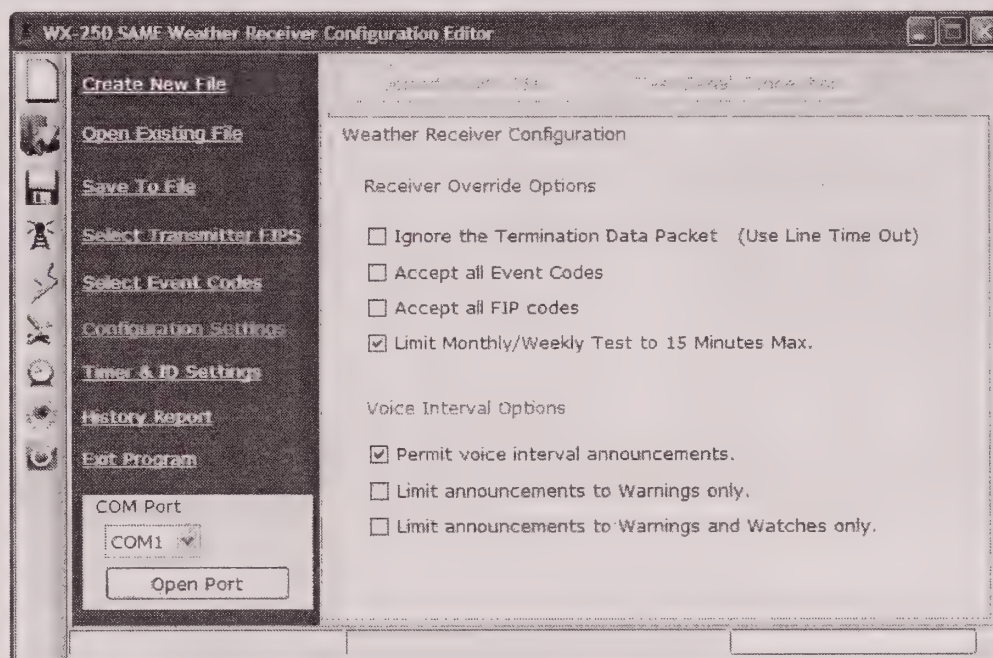


Figure - 8

Receiver Override Options

If the accept all FIP and Event Codes boxes are checked, the WX-250 will respond to all alerts issued by the weather station. Operation is similar to a receiver with 1050Hz decoder only.

Voice Interval Options

When the alert message is finished the weather station sends three termination data packets. Upon receipt of these packets the WX-250 will turn off the line audio and repeater transmitter. The voice synthesizer will continue to announce the alert until the time period has expired. Select the desired voice alert options and click OK.

WX-250 Timer & ID Settings

Select [**Timer & ID Settings**]. Timers include: Line Time-out, Pre Voice Delay Timer, Voice Interval Timer and Relay Activation Delay Timer. Select the desired times.

Line Time-out Value

This timer selects the time the line audio and PTT outputs are active when an alert message is received. A termination data packet is sent at the end of the alert message. Should the weather station fail to send the termination data packet this timer will limit the alert transmission time. A typical alert lasts 90 seconds. Set this timer to a minimum of 120 seconds.

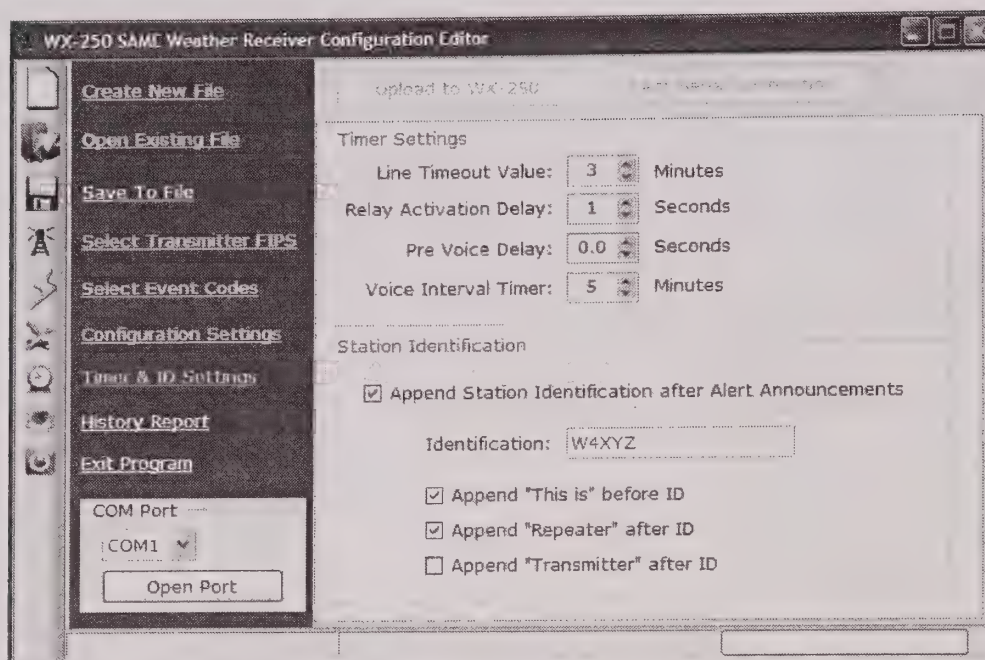


Figure - 9

Relay Activation Delay

When the digital packet is decoded the relay disconnects the transmitter from the controller. If you want to use the features of your repeater's controller to send paging tones, alert tones or a custom voice message announcement this disconnect must be delayed. Use this feature to select the delay.

Pre Voice Delay

This timer selects the delay between activation of the control relay and when the voice synthesizer begins to speak.

Voice Interval Timer Option

Imbedded in the alert information packet is the time the warning or watch is in effect. The time is sent in fifteen-minute increments for the first hour and thirty minute increments for the remaining time of the alert. Once the alert message is finished, the WX-250 voice synthesizer will periodically key-up the repeater transmitter and announce the nature of the alert. This timer sets the time between voice synthesizer announcements.

Station Identification

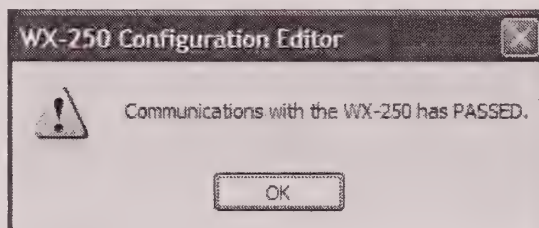
Use the WX-250 voice synthesizer to identify the transmitter at the end of an alert and during the periodic voice weather announcements. Enter your station identification in the Call Letter Box. Valid characters are A-Z and 0-9. Up to fifteen (15) characters can be entered. Additional check boxes are provided to add the words "This is", "Transmitter" and "Repeater" to the identification announcement.

Save File As to Memory

Once you have completed selection of the FIPS and EVENT codes, set the configuration, timers and ID save the file to your computer's memory.

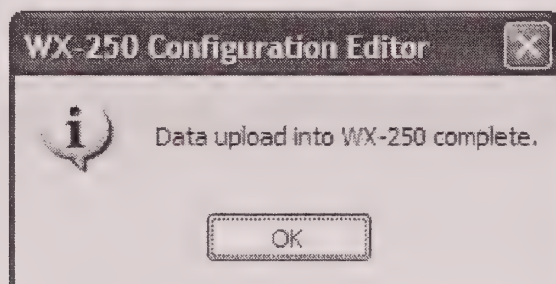
WX-250 Test Serial Port

Click the [**Open Port**] button at the lower left. This will highlight the [**Test Serial Port**] and [**Upload to WX-250**] buttons. Click the [**Test Serial Port**] button to verify the computer can establish communications with the WX-250.



WX-250 Upload to WX-250

Click the [**Upload to WX-250**] button to upload the file created with the WX-250 Editor into the WX-250 memory.



WX-250 History Report

Click the [**Request History Data from WX-250**] button at the lower center to display a list of the alerts stored in the WX-250 memory. Click the [**Erase History**] button to clear the history data.

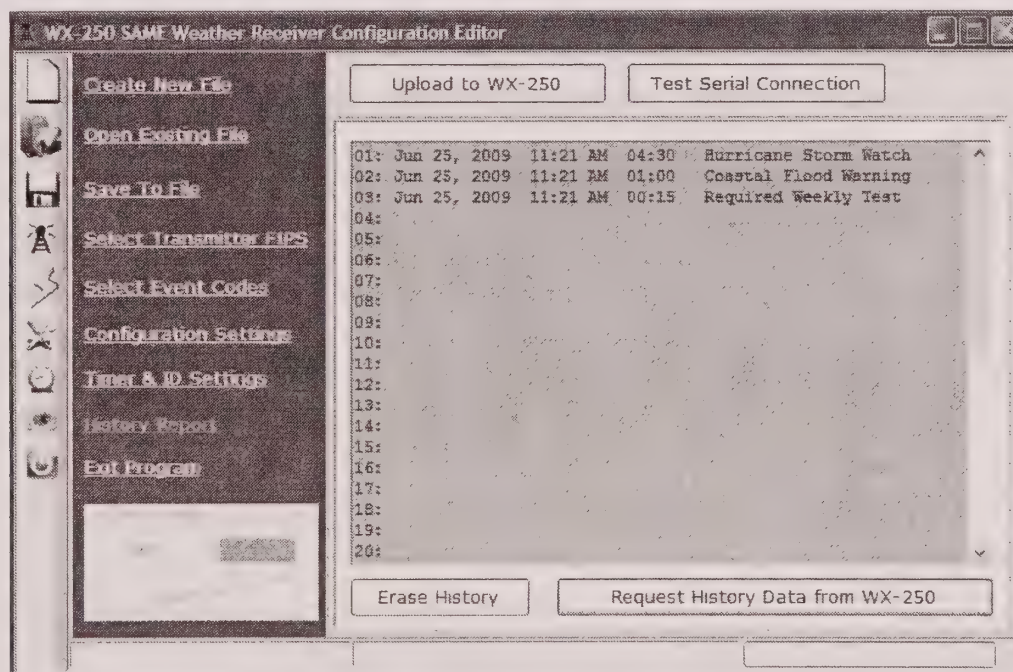


Figure - 10

Voice Read Back of County FIP Codes

After a data transfer, press the FIP code switch S2. The voice synthesizer will read out the county FIP codes stored in memory. Example: The voice will say: "TEST FIP CODES 012011 012086."

Reset WX-250 Memory

If you wish to reset the WX-250 memory and return the WX-250 to factory defaults remove +12VDC power from the WX-250 receiver. Set dipswitch #8 to ON and apply DC power. The WX-250 will reset. After approximately ten seconds the voice synthesizer will say: "WX-250 VERSION 1.XX RESET DATA LOAD COMPLETE" and load the default FIPS codes for South Florida. Set dipswitch #8 to OFF and reprogram the WX-250 for your desired FIPS and EVENT codes.

Raw Data Display

The WX-250 will display the raw data on its RS-232 port when an alert is received. Set dipswitch #7 to ON. Open a communications program such as Hyper-terminal or Tera Term and set the communications for 9600 baud 8N1. Set the flow control to NONE. Figure 11 displays A Tornado Warning simulated by the SG-2000 S.A.M.E signal generator. When finished observing the WX-250 output set dipswitch #7 OFF.

```
$WXTXT,SAME interrupt detected.*2E
$WXTXT,Preamble detected.*53
$WXTXT,StoredOrgEvent OK*72
$WXTXT,Match FIPS OK*20
$WXTXT,Match Event OK*60
$WXALT-WXR-TOR-012011-012086-012099-000000-0015-1231545-WXYZ/NWS-R
$WXTXT,SAME interrupt detected.*2E
$WXTXT,End of packet detected.*3D
```

Figure - 11

Line six displays the raw data received from the NOAA weather transmitter.

WXR-TOR-012011+0015-1231545-WXYZ-NWS

Figure 12 describes how to read the data.

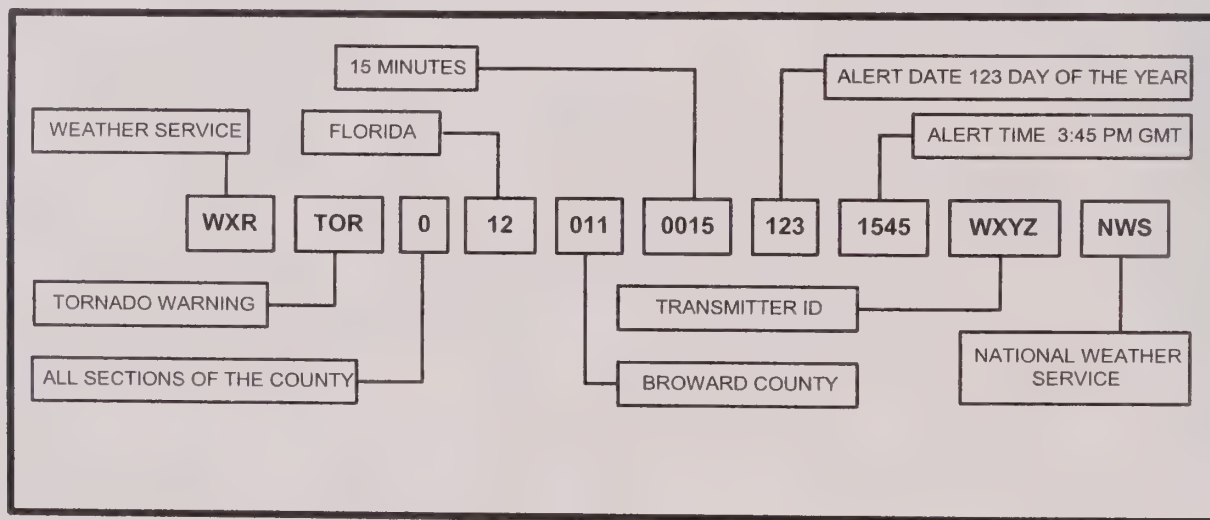
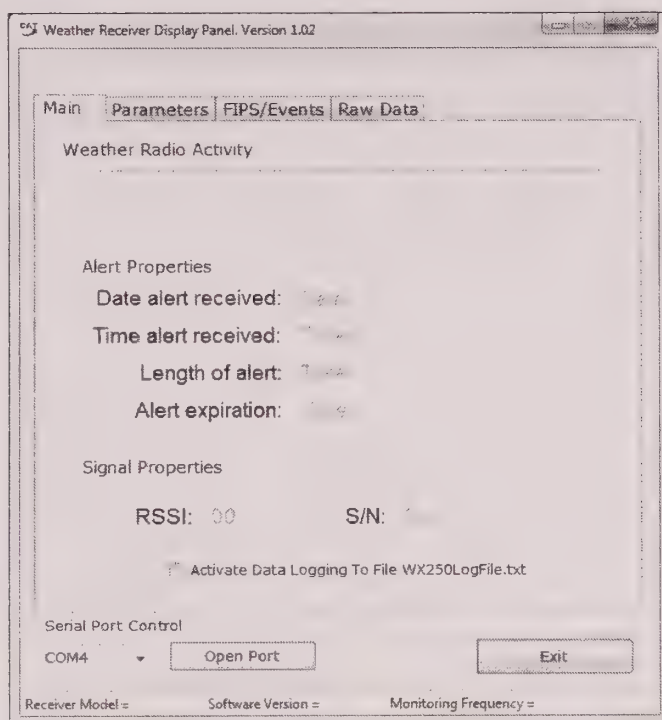


Figure - 12

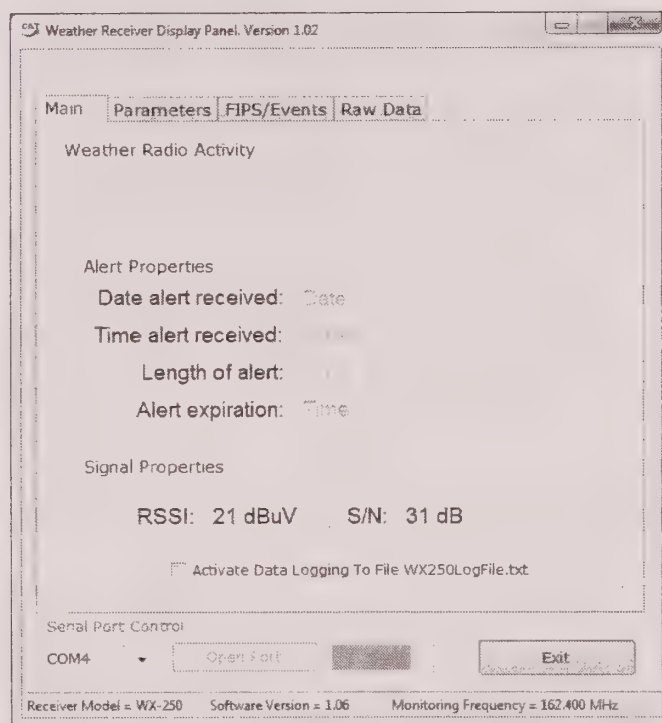
Chapter 5 – Weather Receiver Display Program

Weather Data Display

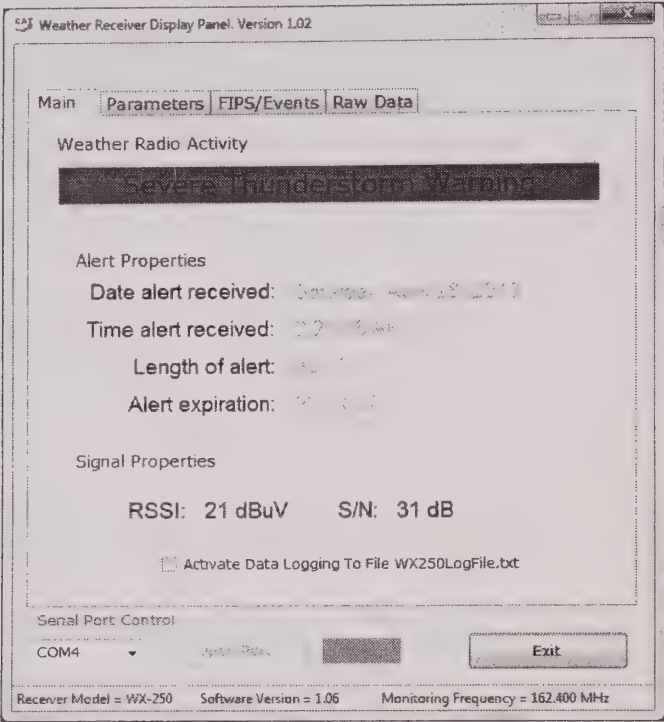
The WX-250 will output data on its RS-232 port. Connect your computer to the WX-250's serial port. Turn ON dipswitch #7 and apply power. From your desktop click the WX-250 Display Icon to open the WX-250 Weather Display program. Select the proper serial COM port and click on the **Open Port** button.



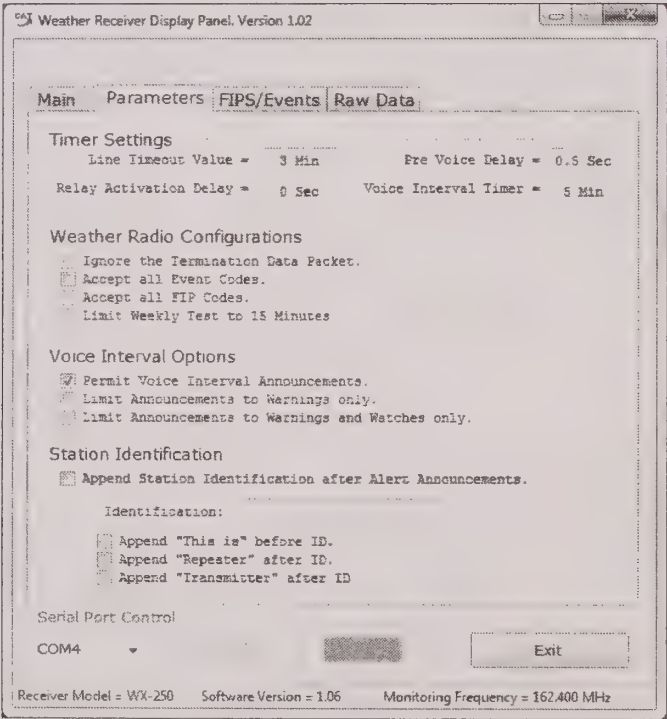
If communications are established a green box will appear to the right of the button. If an antenna is connected to the WX-250 within 60 seconds RSSI and S/N levels should be displayed indicating the strength of the signal being received by the WX-250.



When an alert is received the nature of the alert will be displayed in the window. Warnings are displayed in red, watches in yellow along with the date, time, length and how long until the alert expires.

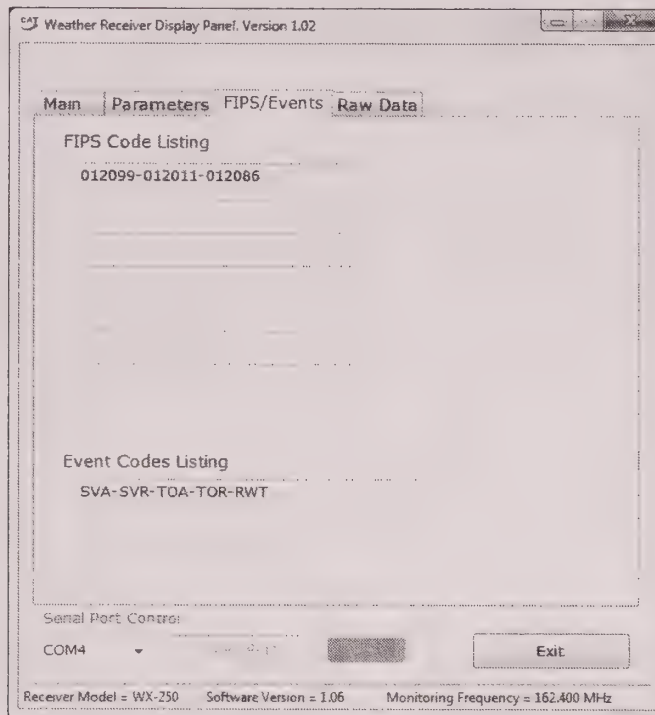


This window displays the Timer Settings, Weather Radio Configurations, Voice Interval Options and Station Identifications programmed into the WX-250 Receiver.



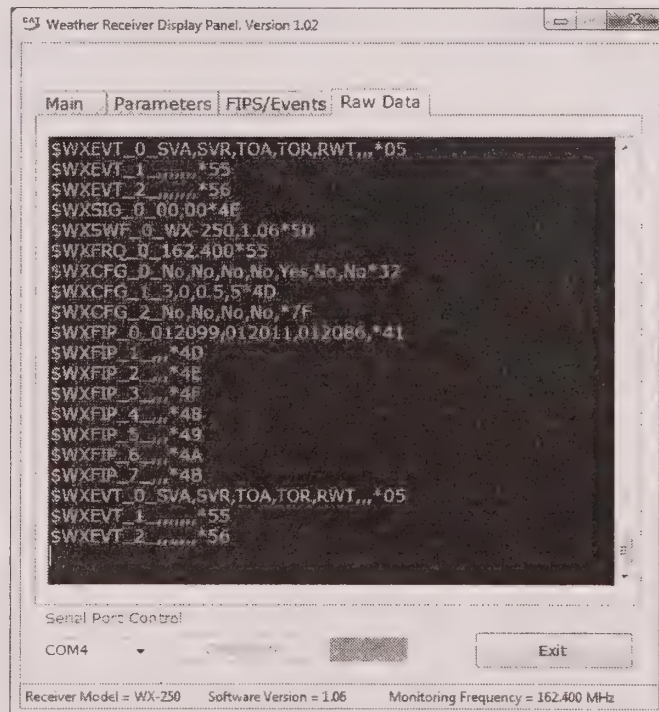
FIPS/Events Window

This window displays a list of the county FIPS codes and the Event codes programmed into the WX-250 Receiver.



RAW Data

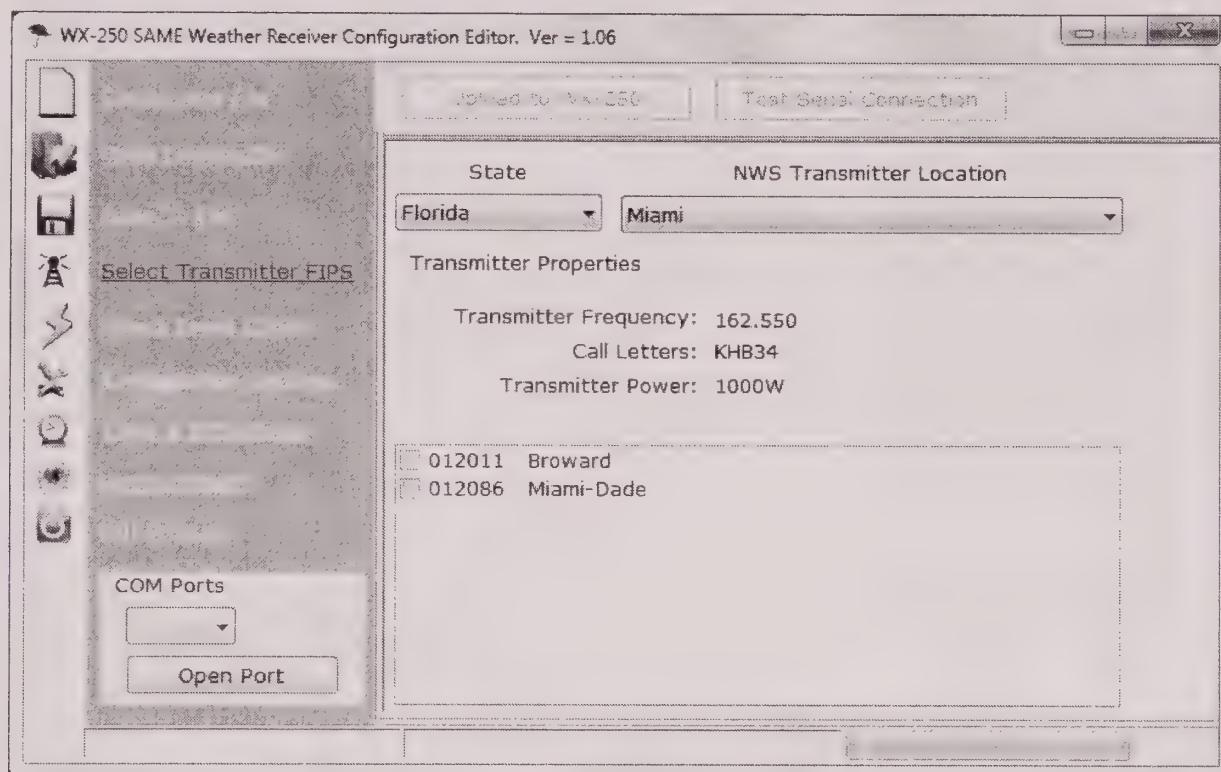
This window displays the raw data being sent out on the WX-250's serial port. The output is continuous and repeats every sixty seconds. There are seventeen fields of data. Everything from the receiver's firmware version, receive frequency and type of alert when received.



If you intend to use the raw data as a digital input to a computer system a detailed document "WX-250 Weather Radio Digital Interface Document" is available in the manual section of the CAT website at: catauto.com/images/PDF/wx250display.pdf

Chapter 6 - Modification of States File

The Miami transmitter provides alerts for Broward and Miami-Dade counties. For the WX-250 to alert these counties their boxes must be checked. The following example describes how to add an additional county to the Miami Florida transmitter window.



NOTE: Your editor must be version 1.06 or higher. If necessary, contact CAT for an upgrade.

This example shows how to add Collier County to the Miami transmitter list.

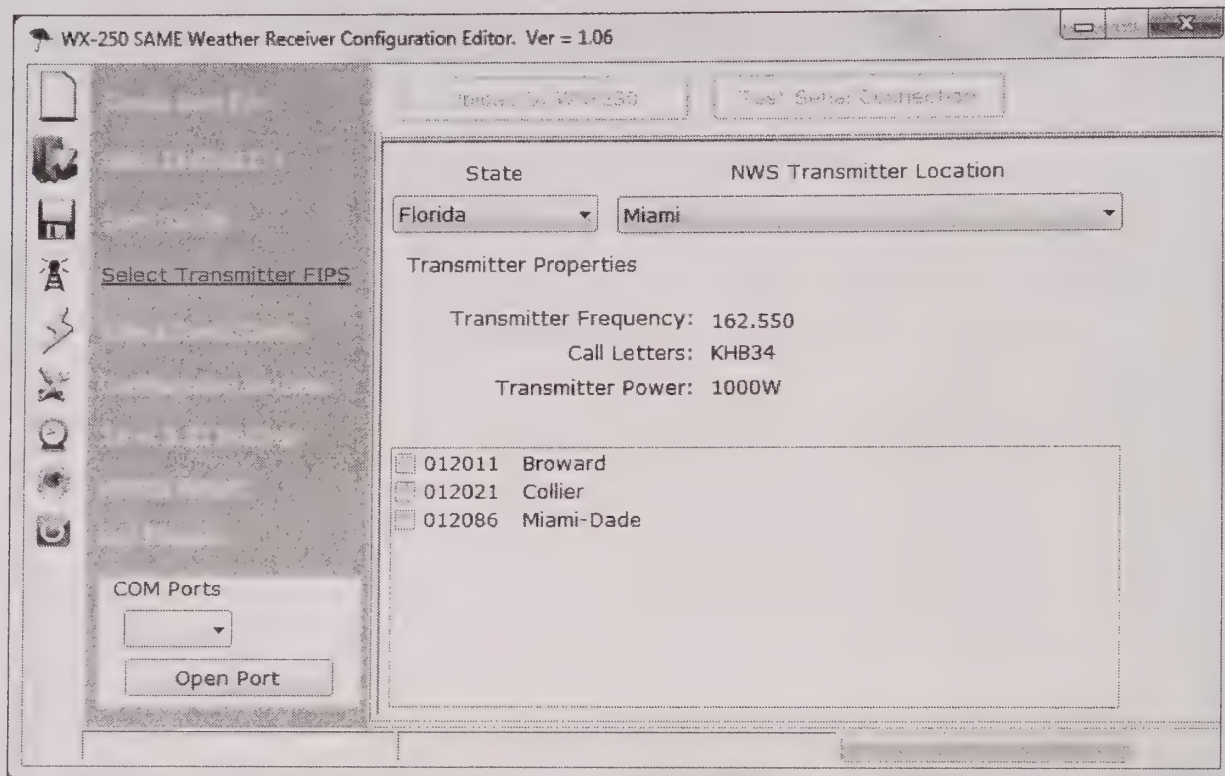
Locate the "States" file at: "Documents/CAT Files/WX-250/States". Open "Florida.fip" in your text editor. Locate "Collier" County in the listing. Insert the new listing.

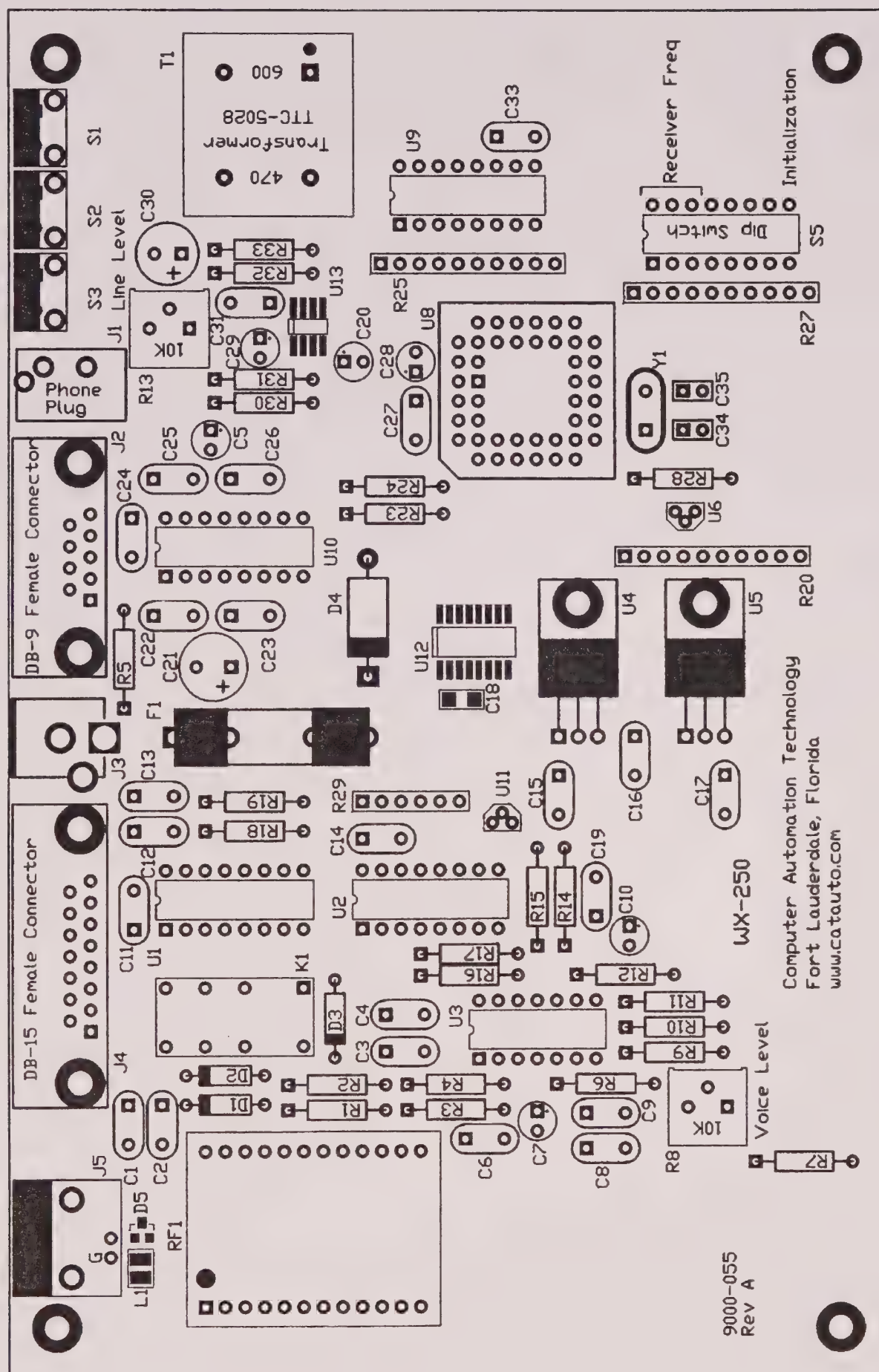
Collier<TAB>012021<TAB>Miami<TAB>162.550<TAB>KHB34<TAB>1000

Citrus	012017	Sumterville	162.500	KFS505	1000
Clay	012019	Gainesville	162.475	WXJ60	1000
Clay	012019	Jacksonville	162.550	KHB39	1000
Clay	012019	Palatka	162.425	WNG522	300
Collier	012021	Fort_Myers	162.475	WXK83	1000
Collier	012021	Naples	162.525	WWG92	1000
Collier	012021	Miami	162.550	KHB34	1000
Columbia	012023	Gainesville	162.475	WXJ60	1000
Columbia	012023	Lake_City	162.400	KEB97	300
DeSoto	012027	Fort_Myers	162.475	WXK83	1000
DeSoto	012027	Venice	162.400	WWG59	1000

Save the file and close the text editor.

Open the WX-250 Weather Receiver Configure editor and see that Collier County has been added to the Miami transmitter list of counties.

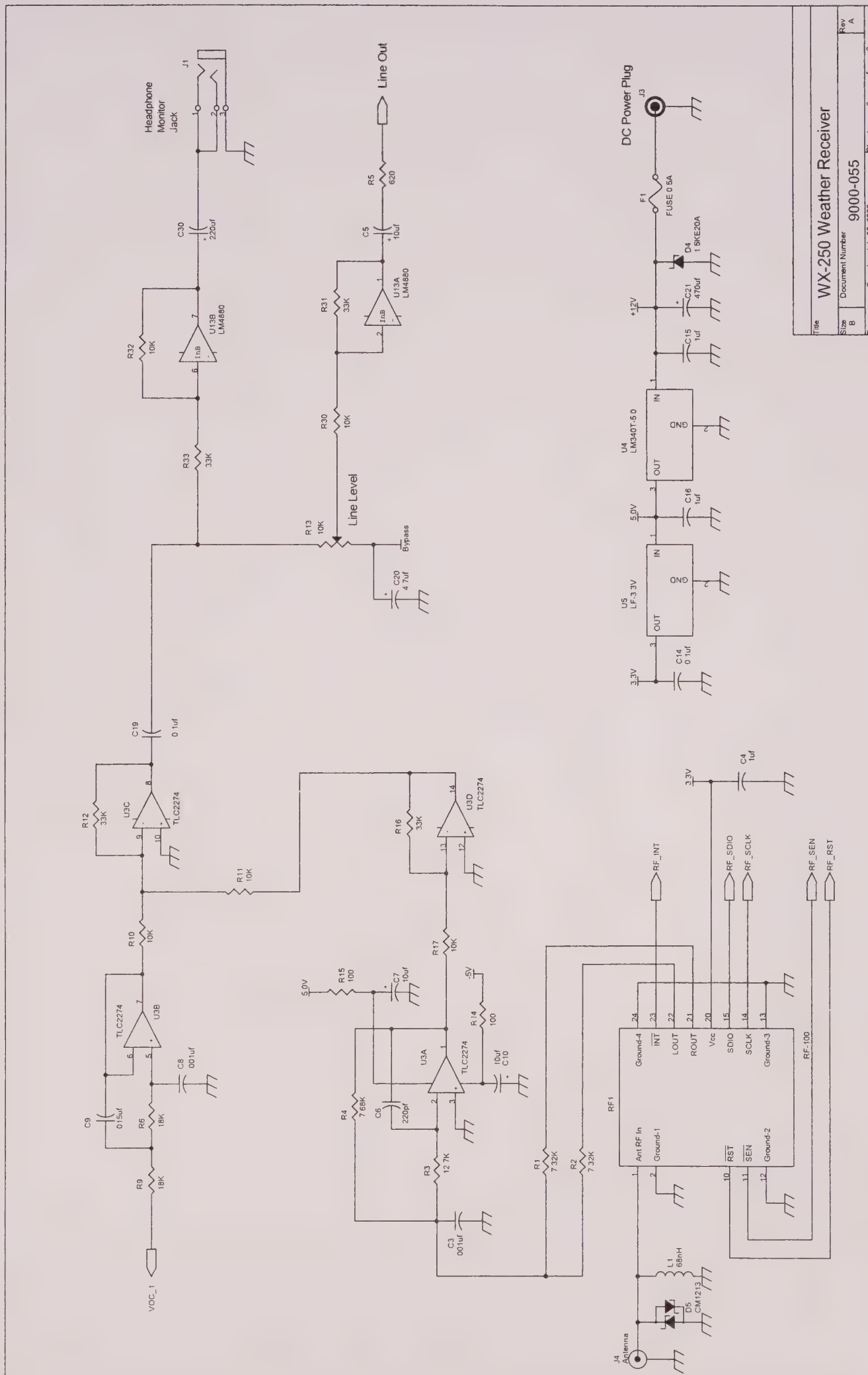




Chapter 8 - Schematic

WX-250 Receiver
WX-250 Receiver

Sheet 1 of 2
Sheet 2 of 2



Title: WX-250 Weather Receiver

Size: B

Document Number: 9000-055

Date: Tuesday, July 28, 2009

Sheet: 2 of 2

Rev: A

Chapter 9 - Part List

2	Capacitor	22pf	C34,C35
1	Capacitor	220pf	C6
2	Capacitor	.001uf	C3,C8
1	Capacitor	.015uf	C9
19	Capacitor	.1uf 50V	C1-C33
2	Capacitor	4.7uf 16V	C20,C28
4	Capacitor	10uf 16V	C5,C7,C10,C29
1	Capacitor	220uf 16V	C30
1	Capacitor	470uf 25V	C21
1	Connector	9D (F)	J2
1	Connector	15D (F)	J4
1	Connector	DC Power	J3
1	Connector	Antenna	J5
1	Connector	Headphone	J1
1	Crystal	12MHz	Y1
3	Diode	1N4148	D1,D2,D3
1	Diode	1.5KE20A	D4
1	Diode	CM1213	D5
1	Fuse	0.5 Amp	F1
1	I.C.	TPIC6C595N	U1
1	I.C.	AM26C31	U2
1	I.C.	TLC2274ACN	U3
1	I.C.	LM340-T5.0	U4
1	I.C.	LF-33CV	U5
1	I.C.	MCP101-315	U6
1	I.C.	AT89C51ED2	U8
1	I.C.	MSP53C391N	U9
1	I.C.	MAX2323	U10
1	I.C.	MCP100-485	U11
1	I.C.	HEP4050B2	U12
1	I.C.	LM4880	U13
1	Inductor	68uh	L1
1	Module	Weather Receiver	RF1
1	Relay	12V DPDT	K1
1	Transformer	TTC-5028C	T1

